Capasso, Maria
Briarcliff High School

The Role of Listening to Preferred Music in Affecting the Memory, Anxiety, and Mood of Adolescents

In the United States, 93% of the population listens to music daily and spends over 25 hours each week listening to music (Nielson, 2014). Music improves physical and emotional wellbeing of a general population (Levitin & Chanda, 2013). Music can also act as a form of therapy, which is defined as the clinical and evidence based use of music interventions on a person or group of people with the guidance of a credentialed therapist (LaGasse, A. B. & Hardy, M. W. 2013), where it has been shown to promote wellness, manage stress, and enhance memory.

Music has a profound impact on brain functioning and the biological, social, and psychological development of adolescents. Therefore, music is used to regulate and enhance mood, arousal, and physical wellbeing in everyday life. It promotes physical and psychological health and well-being in clinical settings (Amarala, 2015) in correspondence with the evoking of sadness, fear, joy, tranquility and other emotions (Levitin & Chanda, 2013). This emotional impact and mood regulation are two of the main reasons as to why teenagers listen to music (Laiho, 2004). Music has the ability to elicit and enhance autobiographical memories. These memories ultimately provoke associated emotions. Since music has consistently been used as a tool for short and long-term memory enhancement, familiar music is often listen to in order to recall significant past events in their lifetimes (Juslin & Vastfjall, 2008).

Adolescence is a developmental stage characterized by various physical, cognitive, emotional, and social changes (Calderone, 2013). Music plays a key role in the biopsychosocial development of adolescents. The examination of the roles of music in the biopsychosocial maturation of adolescents has shown that there is a relationship between music, neurological processes, and the developmental growth of adolescents. (Loewy, J., & Spintge, R., 2011). Music is facilitated by and influences biological structures and processes, including the brain (Peretz & Zatorre, 2003). The results from a brain lesion and neuroimaging study showed that musical exemption is rooted in a multifaceted network of cortical pathways (Peretz & Zatorre, 2005). Music triggers neurotransmitters that elicit pleasure (Menon & Levitin, 2005), controls stress hormones like cortisol, and enhances social bonding (Khalfa, Dalla Bella, Roy, Peretz, & Lupien, 2003).

Music is among lifestyle choices of adolescents that reduce stress, protect against disease, and manage pain (Koelsch, S. and Stegemann, T., 2012). Therefore, adolescent development in the aforementioned aspects is not only benefitted, but enhanced through music. Music consumption is at an all time high during adolescent years because of the adolescents' devotion to music (Levitin & Chanda, 2013). The meaning and importance of music to young people is tied to their psychosocial development. (Miranda, D. 2013). There are four main uses of music

among young people: mood enhancement, coping with problems, defining personal identity, and marking social identity (Bogt, Mulder, Raaijmakers, and Gabhainn, 2011). Because adolescence is a significant time for development, adolescents begin to separate from their parents, learn self-regulation and control, and gain autonomy over their life and emotions (Laiho, 2013).

The motor, cognitive, speech and language, social, emotional, behavioral, and sensory compartments of the brain are all affected by music (Neurorythym, 2015). Music engages both the right and left brain (Chanda, M., & Levitin, D., 2013). Motor skills are enhanced when auditory stimuli rise to higher cognitive processing areas in the brain. They descend down the spinal column at the same time, which results in a reflex that enables the muscles in the body to yield more systematized movement (Koelsch, S., 2012). The brain processes music for cognitive skills by aiding in the memorization of material while captivating and maintaining attention. Consequently, music is used to improve cognitive skills such as attention, memory, mood, and higher level thought processing (Ulfarsdottir, L., & Erwin, P. 1999). Since speech and singing are closely related in function and distance in the brain, speech incorporates musical elements, which facilitates improved communication skills (Katagiri, 2009).

Music stimulates the reward pathways in the brain therefore increasing more socially apropos responses (Neurorythym, 2015). The brain processes music for sensory skills by involving the visual, auditory, and tangible senses. This multi-sensory stimulation allows the proprioceptive skills, input to muscles and joints, vestibular skills, input for balance, and self-regulation processing skills to be improved through music (Chanda, M., & Levitin, D. 2013)**.** Listening to relaxing music with a slow tempo, low pitch, or no lyrics has been shown to reduce stress and anxiety in healthy adult subjects (Dileo, C. and Bradt, J., 2007, Nilsson, U., 2008, and Koelsch, S, 2012).

This research study will focus on investigating the effects of preferred music on the short-term memory, perceived anxiety, and regulating mood in adolescents. Through this study, the relationship between music, neurological processes, and the developmental growth of adolescents will be shown. It is hypothesized that short-term memory, anxiety, and mood will have a negative correlation after listening to preferred music. In other words, when memory and mood increase, anxiety decreases. Furthermore, positive results of the study may help in the understanding of the heightened anxiety, loss of memory, and destruction of mood in people who suffer from neurologic disorders such as traumatic brain injury and the role that music can play in treating these symptoms.

Research Question and Hypotheses

RQ: How does listening to preferred music affect the short-term memory, anxiety, and mood in adolescents?

H0: Listening to preferred music for a set amount of time will not have any effect on the short term memory, anxiety, or mood of adolescents.

H1: Listening to preferred music for a set amount of time will have a positive effect on the short-term memory of adolescents.

H2: Listening to preferred music for a set amount of time will decrease the perceived anxiety of adolescents.

H3: Listening to preferred music for a set amount of time will have a positive effect on the mood of adolescents.

Methods

- Experimental Design
    - This research study will focus on investigating the effects of preferred music on the short-term memory, perceived anxiety, and regulating mood in adolescents. With a convergent parallel mixed methods design, my project includes a control and experimental group. Both groups preform the same tasks and questionnaires; however, the experimental group listens to preferred music during one of the tasks.
- Participants
    - My participants came from a local high school and had to be between the ages of 14-18, which mark ages of the beginning adolescence to the end. I obtained 108 participants, 64 of whom were female and 44 of whom were male. The mean age was 16.67 years.
- Tools
    - Original demographic questionnaire
        - Gender, age, music preferences
    - Visual Analog Scale (VAS) for Perceived Anxiety to measure current/in the moment anxiety levels
    - Positive and Negative Affect Schedule (PANAS)
        - 10 words with a positive connotation and 10 words with a negative connotation were presented to participants. Participants rated each word on a scale of 1-5, 1 being not at all and 5 being extremely, based on how they felt in that moment.
    - Faculty Washington's Short Term Memory Task
        - A series of letters would pop up on the computer screen. After the trial ended, participants wrote down the letters they remembered. As a participant moved forward with trials, the number of letters increased by two.
- Recruitment of participants
    - A word document with the tasks and surveys to carry out my project was created and sent out to over 200 people from Briarcliff High School. 108 people responded and sent the completed document back.
- Procedures
    - In the word document, the participants were asked to fill out a short demographic questionnaire before the pre-tests. Participants in the experimental and control groups performed VAS and PANAS tests as pre and post-tests. Between the pre and post-tests, experimental group participants listened to two of the songs on their playlist during the trials of the short-term memory task. Control group participants performed the short-term memory task without music. After completing the memory test with music, the experimental group participants completed the VAS and PANAS tests as post-tests as well to assess their level of anxiety and possible alteration of mood after the test. Control group participants were also asked to complete the VAS and PANAS tests as post-tests. A short written reflection appeared at the end of the experimental groups' documents to gather qualitative data after the post-tests and identify themes between the results.

Instruments

Visual Analog Scale

Positive and Negative Affect Schedule

Trial #	The letters I remember are...
1	
2	
3	
4	
5	
6	

Short Term Memory Task

Results and Discussion

Data

Participant Demographics

Gender	# of participants	Mean Age
Female	44	
Male	64	
Total	108	16.67

# of participants in Experimental Group	# of participants in Control Group
62	46

Participants ranging from 14-18 years old in the experimental group listed their preferred music genres as hip-hop/rap, pop, country, rock, classical and jazz.

Mood Results

I hypothesized that music would have a positive effect on the mood scores of adolescents. Thus, I hypothesized

that the scores of the experimental group's post-test average will be greater than their own pre-test averages and greater than the control group's post-test averages. On average, adolescents' positive affect schedule sores were higher than their negative affect schedule scores. Both the positive and negative affect scores for both the control and experimental group were examined. On average, the experimental group scored higher on the positive affect schedule in both the pre and post-test than the control group. The experimental group also had average higher overall PANAS scores than the control group.

Experimental Group Pre-Test: Average Scores

Word	Average Score	Word	Average Score	PAS Score	NAS Score
Interested	4	Irritable	2	30.3	15.8
Distressed	2	Alert	3		
Excited	3	Ashamed	2		
Upset	2	Inspired	4		
Strong	1	Nervous	1		
Guilty	1	Determined	3		
Scared	1	Attentive	4		
Hostile	1	Jittery	2		
Enthusiastic	3	Active	5		
Proud	2	Afraid	1		

Experimental Group Post-Test: Average Scores

Word	Average Score	Word	Average Score	PAS Score	NAS Score
Interested	4	Irritable	3	33.5	16.1
Distressed	1	Alert	4		
Excited	3	Ashamed	1		
Upset	2	Inspired	3		
Strong	2	Nervous	1		
Guilty	1	Determined	4		
Scared	1	Attentive	4		
Hostile	1	Jittery	3		
Enthusiastic	4	Active	3		
Proud	3	Afraid	1		

Control Group Pre-Test: Average Scores

Word	Average Score	Word	Average Score	PAS Score	NAS Score
Interested	4	Irritable	2	28.2	14.4
Distressed	3	Alert	3		
Excited	2	Ashamed	2		
Upset	1	Inspired	3		
Strong	1	Nervous	2		
Guilty	2	Determined	4		
Scared	2	Attentive	3		
Hostile	3	Jittery	2		
Enthusiastic	3	Active	3		
Proud	2	Afraid	1		

Control Group Post-Test: Average Scores

Word	Average Score	Word	Average Score	PAS Score	NAS Score
Interested	3	Irritable	1	27.5	13.9
Distressed	3	Alert	4		

Excited	2	Ashamed	2		
Upset	2	Inspired	2		
Strong	1	Nervous	1		
Guilty	3	Determined	4		
Scared	2	Attentive	4		
Hostile	3	Jittery	2		
Enthusiastic	4	Active	4		
Proud	1	Afraid	1		

There were a few participants in the experimental group whose mood did decrease; this mood decrease was accompanied by a high level of anxiety, and therefore, probably affected their overall mood in the moment.

Anxiety Results

A quantitative measurement was taken of the Visual Analog Scales for each participant in both the experimental and control groups for the pre and post-tests. On a 10 centimeter scale, the participants rated the present state of their anxiety from no anxiety at all to anxiety as bad as it could have possibly been. The diagram below depicts the difference in the control and experimental groups, and the difference between the pre VAS and post VAS. These were taken using a measurement tool for each participant.

	Pre VAS Average	Post VAS Average
Experimental Group	5.68 cm	4.56 cm
Control Group	4.34 cm	4.78 cm

Out of the 62 experimental group participants, the average VAS score for the pre-test was 5.68 cm and for the post-test it was 4.56 cm. Out of the 46 control group participants, the average VAS score for the pre-test was 4.34 cm and for the post-test it was 4.78 cm. The average anxiety levels according the VAS were generally lower for the control group than the experimental group. In addition, the average score for the experimental group decreased after the memory test with music. I hypothesized that listening to preferred music would decrease anxiety. The control group anxiety difference in pre-test and post-test was minimal. There could have been a difference in anxiety between the pre and post VAS because participants had to manually mark where their current anxiety was, and through human error, they would not be able to mark the exact same spot for the pre and post-test. Unrelaxing music has been found to keep anxiety stagnant whereas music with a slow tempo, no pitch, or no lyrics has been shown to reduce stress in healthy adult subjects, which is how my results are consistent with the findings of Dileo and Bradt's work in 2007.

Memory Results

The experimental group, which listened to music while performing the memory test, had an average of 82% out of all letters correct versus the control group which had an average of 64% out of all letters correct during the short term memory task. In addition, the qualitative questionnaire indicated that the majority of the people in the experimental group claimed they thought the music was more helpful in remembering the letters than if there was no music. The higher average scores in the experimental group's mood could be correlated with the higher memory scores as preferred music has been found to increase productivity and short term memory.

Conclusion

This study provided insight into the effect of an adolescent's preferred music on their short term memory, mood and anxiety. My first hypothesis was discussed earlier; the average score for the short term memory task was higher by percentage points in the experimental group, which listened to music, than the control group, which didn't listen to music, but not by a significant amount. My second hypothesis was partially confirmed; the anxiety of adolescents decreased in the experimental group, but also decreased minimally in the control group. There is major error here; participants had to rate their own anxiety on a 10 centimeter scale by hand. Also, I had to measure each person's level of anxiety, which ultimately increases the error margin. My third hypothesis discussed the effect of music on the mood of both the experimental and control groups. The experimental groups' mood generally increased.

The fact that it was the participants own preferred music translated into there being a higher chance of a more positive mood after listening to music. Music is truly an influential tool in almost all aspects of life.

For future research, I would ensure that a more closed setting was available. Participants had to answer the questions and complete the tasks on their own time, and the word documents were sent out for convenience but may have skewed the results. I would try to obtain a larger sample size next time. In addition, I would attempt to further analyze the type of music people listened to in relation to their score in each category of memory, mood, and anxiety.

I would like to thank my parents, my mentor, and my science research teachers for their guidance and support for this project.

Bibliography

- Amarala, J. (2015). Effects of auditory stimulation with music of different intensities on heart period. *Journal of Traditional and Complementary Medicine*.
- Ashida, S. (2000). The effect of reminiscence music therapy sessions on changes in depressive symptoms in elderly persons with dementia. Journal of Music Therapy, 37(3), 170-181.
- Bogt , T.F.M. , Mulder , J. , Raaijmakers , Q.A.W. and Gabhainn , S.N. 2011. Moved by music: A typology of music listeners.*Psychology of Music*, 39: 147–163.
- Calderone, Tom. (2013). The Importance of Music Education.
- Chuang, C., Han, W., Li, P., & Young, S. (n.d.). Effects of music therapy on subjective sensations and heart rate variability in treated cancer survivors: A pilot study.*Complementary Therapies in Medicine,* 224-226.
- Chanda, M., & Levitin, D. (2013). The neurochemistry of music. *Trends in Cognitive Sciences,* 179-193.
- Dileo, C. and Bradt, J. (2007) Music therapy: applications to stress management. In Principles and Practice of Stress Management (Lehrer, P.M. et al., eds), pp. 519–544, Guilford Press 50
- Huron , D. 2003. "Is music an evolutionary adaptation?". In *The cognitive neuroscience of music*, Edited by: Peretz , I. and Zatorre , R. 57–75. New York: Oxford University Press
- Juslin , P.N. , Liljeström , S. , Västfjäll , D. , Barradas , G. and Silva , A. 2008. An experience sampling study of emotional reactions to music: Listener, music, and situation. *Emotion*, 8: 668–683.
- Katagiri, J. (2009). The effect of background music and song texts on the emotional understanding of children. Journal of Music Therapy, 46(1), 15-31
- Khalfa , S. , Dalla Bella , S. , Roy , M. , Peretz , I. and Lupien , S.J. 2003. Effects of relaxing music on salivary cortisol level after psychological stress. *Annals of the New York Academy of Science*, 999: 374–376.
- Knight,W.E.J. and Rickard, N.S.(2001)Relaxing music prevents stress induced increases in subjective anxiety, systolic blood pressure, and heart rate in healthy males and females. J. Music Ther. 38, 254–272
- Koelsch, S. and Stegemann, T. (2012) The brain and positive biological effects in healthy and clinical

populations. In Music, Health, and Wellbeing (MacDonald, R.A.R. et al., eds), pp. 436–456, Oxford University Press 52

- LaGasse, A. B. & Hardy, M. W. (2013). Considering rhythm for sensorimotor regulation in children with Autism Spectrum Disorders. Music Therapy Perspectives, 31(1). 67-77. National Autism
- Laiho, S. (2013). The Psychological Functions of Music in Adolescence. *Nordic Journal of Music Therapy,* 47-63.
- Loewy, J., & Spintge, R. (2011). Prelude to the Special Issue in Music and Medicine: Music Therapy and Supportive Care. *Music and Medicine*, 5-6.
- McDermott , J. and Hauser , M. 2005. The origins of music: Innateness, uniqueness, and evolution. *Music Perception*, 23: 29–59.
- McIntosh, G., Thaut, M., Rice, R., Miller, R., Rathbun, J., & Brault, J. (1995). Rhythmic facilitation in gait training. Annals of Neurology, 38, 331.
- Miranda, D. (2013). The role of music in adolescent development: Much more than the same old song. *International Journal of Adolescence and Youth, 18*(1), 5-22.
- Mitchell , L.A. and MacDonald , R.A.R. 2006. An experimental investigation of the effects of preferred and relaxing music listening on pain perception. *Journal of Music Therapy*, 43: 295–316.
- Menon , V. and Levitin , D.J. 2005. The rewards of music listening: Response and physiological connectivity of the mesolimbic system. *NeuroImage*, 28: 175–184
- NeuroRhythm Colorado Springs Music Therapy Services. Retrieved September 21, 2015.
- Nielson. (2014). Music 360. What People Watch, Listen To and Buy
- Nilsson, U. (2008) The anxiety- and pain-reducing effects of music interventions: a systematic review. AORN J. 87, 780–807 51
- Nilsson , U. 2009. Soothing music can increase oxytocin levels during bed rest after open-heart surgery: A randomized control trial. *Journal of Clinical Nursing*, 18: 2153–216
- Peretz , I. and Zatorre , R. 2005. Brain organization for music processing. *Annual Review of Psychology*, 56: 89–114.
- Rentfrow , P.J. and Gosling , S.D. 2006. Message in a ballad: The role of music preferences in interpersonal perception.*Psychological Science*, 17: 236–242.
- Ulfarsdottir, L., & Erwin, P. (1999). The influence of music on social cognitive skills. *The Arts in Psychotherapy*, 26(2), 81-84.